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DRA/MARSHALL

November 13, 1984

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Alabama 35812

ATTN: Dr. D. E. Fitzjarrald (ED42)

SUBJECT: Monthly Progress Report--Development of a Global Model for Atmospheric Backscatter at CO_2 Wavelengths

CONTRACT: NAS8-35594

PERIOD: October 14 - Nov··ber 13, 1984

Dear Dr. Fitzjarrald:

Work Carried Out

Work has continued on the tasks shown below.

Task 1.1 To examine experimentally measured size distributions for the free troposphere, fit bimodal log-normal models with different refractive indices for the two modes and calculate β_{CO_2}

Work has continued on the use of experimentally determined bimodal size distributions to model the ratio (backscatter at 10.6 µm/extinction at 1.00 µm). Values so far obtained lie in the range 4×10^{-5} sr^{-1} - 4×10^{-3} sr^{-1}. Although the distinction is not absolute, the lower values tend to apply to the remote free troposphere, the higher values to boundary layer and arctic haze conditions, containing numbers of larger particles. Further work on this will continue using size distributions supplied by E. Patterson of the Georgia Institute of Technology.

Task 1.2 To investigate the effect of aerosol microphysical processes, occurring in an aerosol plume which undergoes transport in the atmosphere, on its β_{CO_2} value

Work has continued on the development of the 1-dimensional model to investigate the effect of aerosol microphysical processes on its β_{CO_2} value. In particular, the vertical diffusion coefficient has been modified. The original coefficient used does not vary with altitude. It has been replaced by the diffusion coefficient in the troposphere given by Liu et al. (1984, J. Geophys. Res., 89, 7291-7297).

(NASA-CR-174053) DEVELOPMENT OF A GLOBAL MODEL FOR ATMOSPHERIC BACKSCATTER AT CO2 WAVELENGTHS Monthly Progress Report, 14 Oct. - 13 Nov. 1984 (Institute for Atmospheric Optics and Remote) 6 p

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Task 2.1 Use of the SAGE/SAM II data set

(i) Extinction-temperature correlation

Further study has been made of the correlation between aerosol extinction at heights near the tropopause and the local temperature. Preliminary results from this study are rather surprising. At low latitudes, the satellite extinction does not appear to be correlated with temperature. At high latitudes in both hemispheres, high extinction values are correlated with lower temperatures. An example of this is shown in Fig. 1. The aerosol extinctions have been grouped into four ranges based on the extinction probability distributions. (For 20°S - 20°N, Range 1 is 0 - 1.5 x 10^{-4} km^{-1}, Range 2 is 1.5 - 2 x 10^{-4} km^{-1}, Range 3 is 2 - 10 x 10^{-4} km^{-1} and Range 4 is 10 - 300 x 10^{-4} km^{-1}; for 60°N - 75°N, Range 1 is 0 - 2 x 10^{-4} km^{-1}, Range 2 is 2 - 3 x 10^{-4} km^{-1}, Range 3 is 3 - 10 x 10^{-4} km^{-1} and Range 4 is 10 - 300 x 10^{-4} km^{-1}.) The figure shows the lack of temperature dependence at low latitudes and the high negative temperature correlation for high northern latitudes. High southern latitudes (using SAM II data) also show a high negative correlation. This pattern of behavior is repeated in other seasons.

(ii) Latitude-Altitude dependence of extinction

Figure 2 (a) shows plots of 1 μm SAGE extinction for December 1980 - February 1981, as a function of altitude for different latitude bands. The latitude behavior of the tropospheric extinction is similar to that observed in the previous year (Fig. 2(b)) except for the latitude band 40°N - 60°N. This is strongly enhanced by the effects of material injected by the eruption of Mt. St. Helens in May 1980. This material, although injected into the stratosphere and forming a reservoir there, appears to be mixing downwards and increasing the tropospheric aerosol content at all altitudes above about 5 km. It may be noted that the stratopsheric aerosol extinction is also enhanced at low latitudes, due mainly to the eruption of Ularvun in October 1980. A similar stratospheric enhancement occurs between 20°N and 60°N due to the material from the Mt. St. Helens' eruption.

Task 2.2 Use of the GAMETAG Data Set

Dr. E. Patterson at Georgia Institute of Technology is putting the final touches on his report. He will present the results to IFAORS soon.

for Po-Huan Wang
G. S. Kent

cc: Code AP29-F
AS24D
AT01
EM13A-41
DCAS
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NASA Scientific &
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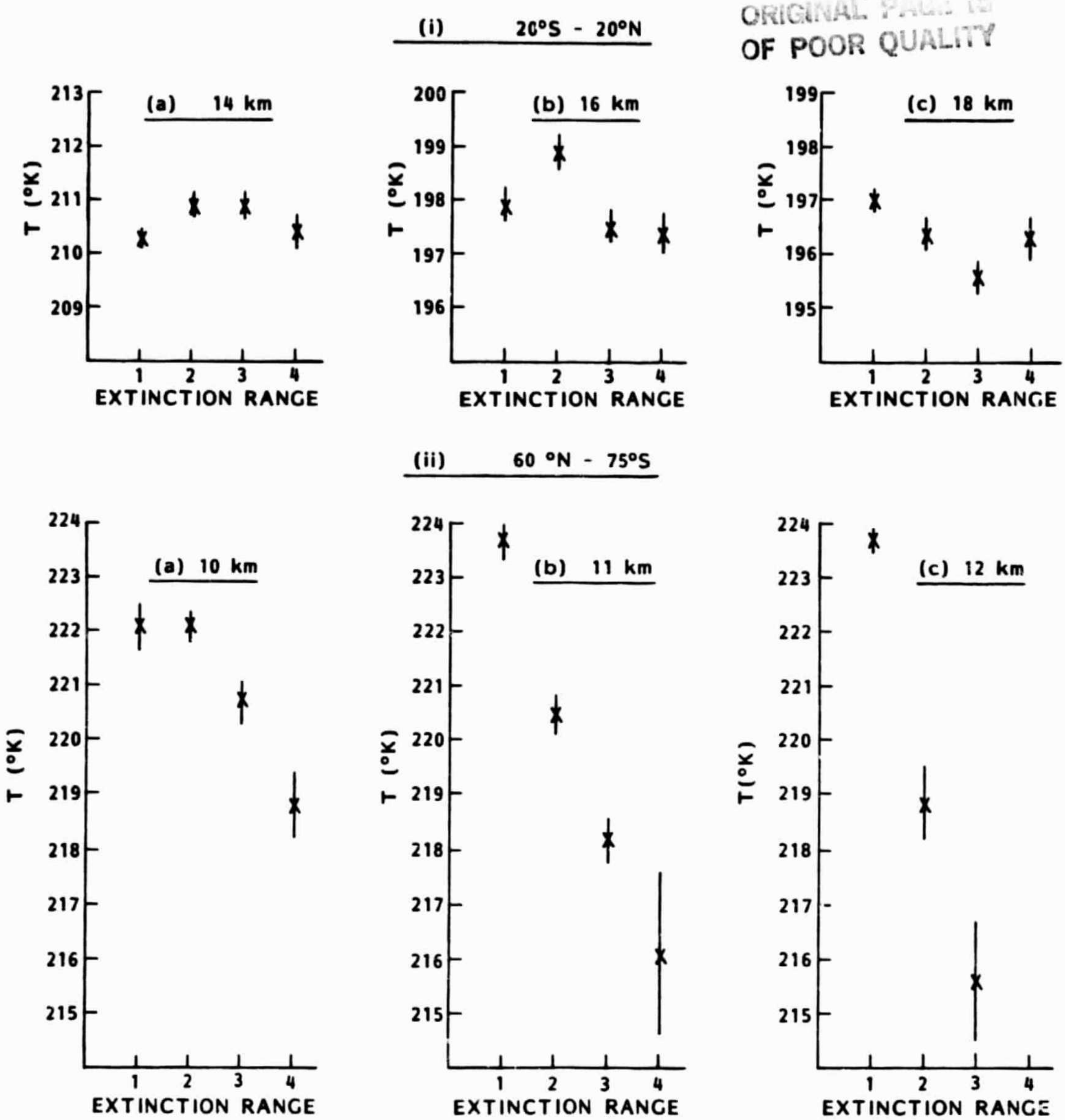

Figure 1. Relationship between temperature and extinction range (extinction increasing from 1→4) for altitudes near the tropopause, within two different latitude bands, between March and May, 1979.

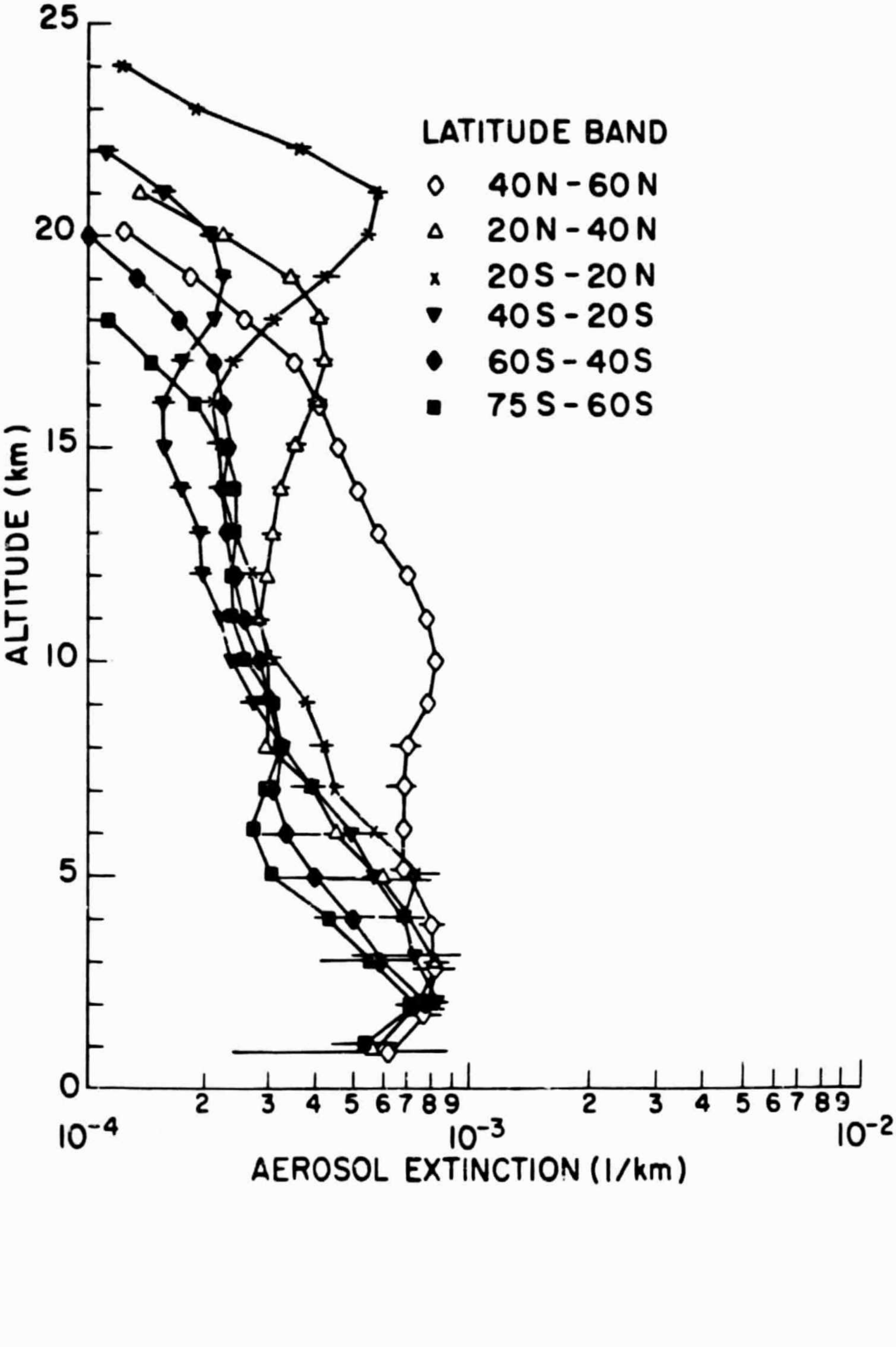

Figure 2.(a). SAGE Aerosol Comparison, December, 1980 - February, 1981.

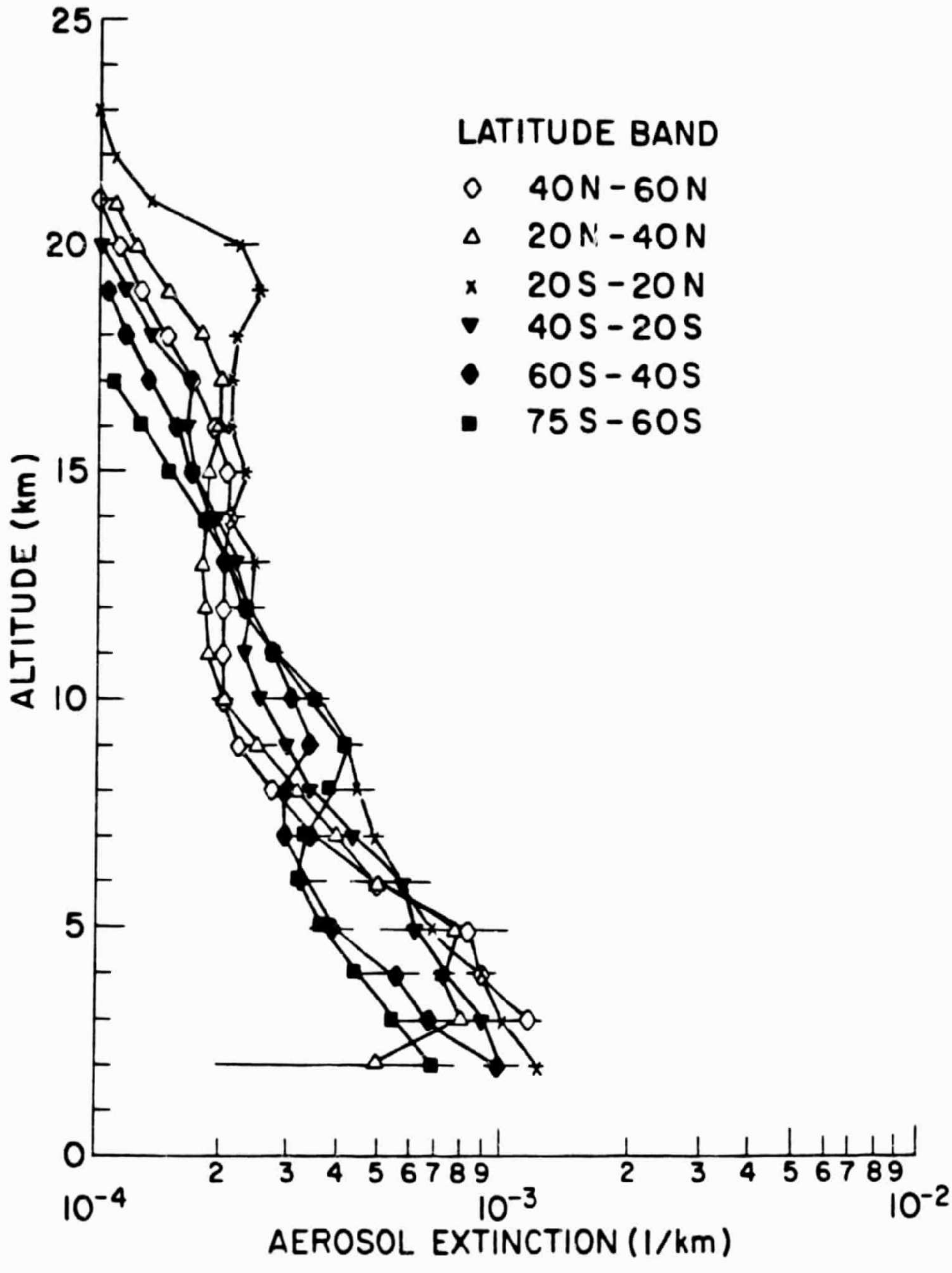

Figure 2.(b). SAGE Aerosol Comparison, December, 1979 - February, 1980.